

Document:

Patent Application No.: Hei 10-57214

Sequence No.: POS61228

Submission Date: March 9, 1998

Destination: Commissioner of Patent
Office

International Patent Classification: G 02 F 1/13

Title of Invention: Production of an Organic
EL Display Device

Japanese Title: Yuhki EL hyhoji souchi no
seizoh houhoh

No. of Patent Claims: 7

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Indication of Fees:

Prepayment registration No.:

013044

Payment amount:

21000

Content Submitted:

Name of Document:

Specification 1

Name of Document:

Figures 1

Name of Document:

Summary sheet 1

Comprehensive Power of Attorney No.: 9711684

Proof Required:

Yes

Receipt

March 9, 1998

Commissioner of
Patent Office

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Submission Date: March 9, 1998

The document below was received.

Patent application, POS61228 59800131876 Japanese Patent Application
No. Hei 10-57214

this patent.]

[There are no amendments to

[p. 1]

[Document] Specification

[Title of the invention] Production of an organic EL display device

[Claims of the invention]

[Claim 1] In the manufacture of an organic EL display device used for a simple matrix drive, a method of producing the organic EL display device characterized by the fact that a light-heat conversion layer and a heat propagation layer are formed on a film; subsequently, a cathode layer is formed; then, a luminous layer is laminated, and an adhesive layer for positive hole injection is further laminated, and the above-mentioned multilayer film is applied to a substrate having an ITO film with a striped pattern; then, a laser [beam] is applied from the backside of the film to form the cathodic shape and the above-mentioned multilayer structure is transferred to the substrate, removal of the film is further performed and the driving means is connected to the substrate transferred along with the above-mentioned multilayer structure, and finally, sealing is performed.

[Claim 2] In the manufacture of an organic EL display device used for a simple matrix drive, a method of producing an organic EL display device characterized by the fact that a light-heat conversion layer and a heat propagation layer are formed on a film; subsequently, a cathode layer, is formed, then, an electric field emitting adhesive layer is laminated, and the above-mentioned multilayer film is applied to a substrate having an ITO film with a striped pattern; then, a laser [beam] is applied from the backside of the film to

form the cathodic shape and the above-mentioned multilayer structure is transferred to the substrate, removal of the film is further performed and the driving means is connected to the substrate transferred along with the above-mentioned multilayer, and finally, sealing is performed.

[Claim 3] The method of producing an organic EL display device described in Claim 1 or Claim 2, in which an electron injection layer is formed between the above-mentioned cathode layer or the above-mentioned electric field emitting adhesive layer and the above-mentioned luminous layer.

[Claim 4] In the manufacture of an organic EL display device used for simple matrix drive, a method of producing the organic EL display device characterized by the fact that a light-heat conversion layer and a heat propagation layer are formed on a film; subsequently, an anode layer is formed, and a positive hole injection layer is formed; then, a luminous layer is laminated, and an adhesive layer for positive hole injection is laminated, and the above-mentioned multilayer film is applied to a substrate having a cathode with a pattern; then, a laser [beam] is applied to the film from the backside of the film so as to form an anodic shape and the above-mentioned multilayer is transferred to the substrate, removal of the film is carried out and the driving means is connected to the substrate transferred along with the above-mentioned multilayer structure, and finally, sealing is performed.

[p. 2]

[Claim 5] In the manufacture of an organic EL display device used for simple matrix drive, a method of producing an organic EL display device characterized by the fact that a light-heat conversion layer and a heat propagation layer are formed on the film; subsequently, an anode layer is formed, and a positive hole injection layer is formed; then, the above-mentioned multilayer film is applied to a substrate having a cathode with a pattern; then, a

laser [beam] is applied to the film from the backside of the film so as to form the anodic shape and the above-mentioned multilayer is transferred to the substrate, removal of the film is carried out and the driving means is connected to the substrate transferred along with the above-mentioned multilayer, and finally, sealing is performed.

[Claim 6] The method of producing an organic EL display device described in Claim 1, Claim 2, Claim 4 or Claim 5, in which the above-mentioned luminous layer or electric field emitting adhesive layer is produced by coating luminescent materials capable of emitting different colors by means of an ink-jet head.

[Claim 7] The method of producing an organic EL display device described in Claim 6 above in which an ink isolation means is provided between each color area before coating the above-mentioned luminous layer or electric field emitting adhesive layer via the ink-jet head.

[Technical field of invention]

[Technical field of invention]

The present invention pertains to a method of producing an organic EL display device used for spontaneous light emission type simple matrix drive medium capacity or high capacity monochromatic or color displays, for viewfinders of camcorders and digital cameras.

[Prior art]

Historically, difficulties in the formation of the cathodic pattern in a simple matrix organic EL display device have been pointed out. The above-mentioned problems are based on likelihood of the organic layer that forms the base of the cathode becoming wet with a solvent. In an attempt to eliminate the above-mentioned problems, various techniques for pattern formation of the cathode have been developed. For example, a method wherein the three RGB colors are

separated by means of a physical mask as disclosed in Japanese Kokai Patent Application No. Hei 8-227276, a method wherein a cathode partition wall is produced ahead of time, and pattern formation for the cathode is carried out at the time of cathodic deposition as disclosed in United States Patent No. 5294869, etc., can be mentioned.

Furthermore, as described in Applied Physics Letters, September 21, 1987, vol. 51, p.913, an organic EL element having a structure wherein a transparent electrode formed on a glass substrate has been mainly used in the past, and the light is emitted through the glass substrate.

[p. 3]

[Problems to be solved by the invention]

However, in a method where a physical mask is used, high precision is less likely to be achieved and positioning is difficult as well. Furthermore, when a cathode partition wall is used, an etching process is used to form the cathode partition wall; thus, the process is complicated.

Furthermore, emission occurs through the glass substrate, thus, leakage of light in the plane direction of the substrate increases and only 20% of the total light emitted is utilized.

Based on the above background, the objective of the present invention is to provide a very simple method of pattern formation for the electrode and luminous layer in the production of an organic EL display device, and to provide a method capable of emitting all of the emitted light in the viewing direction.

[Means to solve the problem]

Means to solve the problem 1

Production of the organic EL display device of the present invention, which is an organic EL display device characterized by the fact that a light-heat

conversion layer and a heat propagation layer are formed on a film, and, subsequently, a cathode layer is formed; then, a luminous layer is formed, and an adhesive layer for positive hole injection is formed, and the above-mentioned multilayer film is applied to a substrate having an ITO with a striped pattern; then, a laser [beam] is applied to the film from the backside of the film to form the cathodic shape and the above-mentioned multilayer structure is transferred to the substrate, the film is removed and a driving means is connected to the substrate transferred with the above-mentioned multilayer, and finally, sealing is performed to produce the organic EL display device of the present invention used for simple matrix drives. According to the above-mentioned structure, pattern formation of the cathode, which is usually very unstable and pattern formation is difficult, can be easily achieved by means of a laser at the time of transfer of the organic EL layer.

Means to solve the problem 2

Production of the organic EL display device of the present invention, which is an organic EL display device characterized by the fact that a light-heat conversion layer and a heat propagation layer are formed on a film, and, subsequently, a cathode layer is formed; then, an electric field emitting adhesive layer is applied, and the above-mentioned multilayer film is applied to a substrate having an ITO with a striped pattern; then, a laser [beam] is applied to the film from the backside of the film to form the cathodic shape and the above-mentioned multilayer structure is transferred to the substrate, the film is removed and the driving means is connected to the substrate transferred along with the above-mentioned multilayer, and finally, sealing is performed in the production of an organic EL display device used for simple matrix drive. According to the above structure, pattern formation of the cathode, which is usually very unstable

and pattern formation is difficult, can be easily achieved with a laser at the time of transfer of the organic EL layer.

[p. 4]

Means to solve the problem 3

In the production method of the present invention, an electron injection layer is formed between the luminous layer and the cathode layer of the above-mentioned means to solve the problem 1, or between the electric field emitting adhesive layer and the cathode layer of the above-mentioned means to solve the problem 2.

Means to solve the problem 4

In the production method of the organic EL display device of the present invention, a light-heat conversion layer and a heat propagation layer are formed on a film; subsequently, an anode layer is formed, and a positive hole injection layer is formed; then, a luminous layer is formed, and an adhesive layer for positive hole injection is further laminated, and the above-mentioned multilayer film is applied to a substrate having a cathode with a pattern; then, a laser [beam] is applied to the film from the backside of the film to form the anodic shape and the above-mentioned multilayer structure is transferred to a substrate, the film is removed and the driving means is connected to the substrate transferred with the above-mentioned multilayer structure, and finally, sealing is performed.

According to the above-mentioned structure, pattern formation of the cathode, which is very unstable and for which pattern formation is difficult, can be easily achieved by means of a laser after forming the cathode on a glass substrate, and patterning of the anode can be easily achieved at the time of transfer of the organic EL layer. Furthermore, in the above-mentioned structure, the emission

of the light occurs without a glass substrate and the light can be directly emitted; thus, loss of light does not occur and the intensity of light can be increased.

Means to solve the problem 5

The present invention is a method of producing an organic EL display device characterized by the fact that a light-heat conversion layer and a heat propagation layer are formed on a film; subsequently, an anode layer is formed, and a positive hole injection layer is formed; then, the above-mentioned multilayer film is applied to a substrate having a cathode with a pattern; then, a laser [beam] is applied to the film from the backside of the film to form the anode shape, and the above-mentioned multilayer is transferred to a substrate; film removal is carried out and the driving means is connected to the substrate transferred along with the above-mentioned multilayer, and finally, sealing is performed in the method of producing an organic EL display device used for simple matrix drives. According to the above structure, pattern formation of the cathode, which is very unstable and for which pattern formation is difficult, can be easily achieved by means of a laser after forming the cathode on a glass substrate, and patterning of the anode can be easily achieved at the time of transfer of the organic EL layer. Also, the production process is simplified since the adhesive layer doubles as the light emitting layer. Furthermore, according to the above-mentioned structure, the emission of light occurs without a glass substrate and the light can be directly emitted; thus, loss of light does not occur and the intensity of the light can be increased.

[p. 5]

Means to solve the problem 6

In the method of production of the present invention, the above-mentioned luminous layer or electric field emitting adhesive layer is produced by coating luminescent materials capable of emitting different colors with an ink-jet head.

According to the above-mentioned method, luminous layers having different colors can be easily formed on the film; thus, a color simplex matrix display device can be easily produced.

Means to solve the problem 7

In the method of production of the present invention, an ink isolation means is formed between each color area before coating the above-mentioned luminous layer or electric field emitting adhesive layer by an ink-jet head.

According to the above-mentioned structure, color overlap with adjoining picture elements does not occur at the time of formation of each luminous layer by means of an ink-jet head and a striped luminous layer can be produced.

[Embodiment of the invention]

Application Example 1

In this application example, an example of a method of producing a simplex matrix used for organic EL display device wherein a light-heat conversion layer and a heat propagation layer are formed on a film, and, subsequently, a cathode layer is formed; then, a luminous layer is applied, and an adhesive layer for positive hole injection also is formed, and the above-mentioned multilayer film is applied to a substrate having an ITO with a striped pattern; then, a laser [beam] is applied to the film from the backside of the film to form a cathodic shape and the above-mentioned multilayer is transferred to the substrate, the film is removed and the driving means is connected to the substrate transferred along with the above-mentioned multilayer, and finally, sealing is performed. A cross-section diagram that shows the manufacturing process of the organic EL display device of the present invention is shown in Fig. 1 through Fig. 6.

First, as base film 1, a polyethylene terephthalate film with a thickness of 0.1 mm was used, and for layer 2 that converts the laser beam to heat,

thermosetting epoxy resin 5 with carbon particles mixed with it was coated to form a thickness of 5 microns and curing was further performed at room temperature. Then, as a heat propagation layer and release layer 3, a poly-methyl styrene film was coated to form a thickness of 1 micron, and for cathode layer 4 (Fig. 1), an aluminum:lithium (10:1) layer was further deposited on the surface of the above-mentioned layer to a thickness of 200 nm.

[p. 6]

Subsequently, Alq3

[Chemical formula 1]

//Chemical formula 1 here//¹

was further deposited as luminous layer 5 to form a thickness of 70 nm (Fig. 2).

Furthermore, as a positive hole injection adhesive layer 6, dissolving was performed for a mixture comprising NPD

[Chemical formula 2]

//Chemical formula 2 here//

and polyvinyl carbazole in a solvent, coating and drying was performed to form a thickness of 60 nm (Fig. 3).

The film produced above was applied to transparent glass substrate 8 having an ITO with 256 stripes (Fig. 4).

Subsequently, pattern formation of 64 stripes was carried out from the film side with 13W YAG laser 9 in the direction perpendicular to the striped pattern of the ITO (Fig. 5).

¹ [Translator's note: please see Japanese source document for chemical structures.]

When the film was removed, an organic EL substrate having 256 x 64 picture elements with the structure shown in Fig. 6 was produced.

Drivers 14 and 15 and controller 16 were connected to the above-mentioned organic EL element 11 as shown in Fig. 7, a transparent protective substrate was applied with a uv-curable sealer 13 and ultraviolet was applied from the protective layer side and sealing was performed. When power and a signal were applied to the display device produced above, image display was possible.

For the transfer film used in the above application example, in addition to polyester, the majority of films such as polycarbonates and polyether sulfones can be used as well.

As for the material used for the light-heat conversion layer in the application example, in addition to a resin mixed with carbon, a material capable of converting the laser beam efficiently to heat can be used as well.

For the heat propagation layer used in the application example, in addition to those listed above, a material having a low melting point (approximately 100 C preferred) and capable of withstanding the heat generated at the time of formation of electrode can be used.

For the cathode material formed in the application example, aluminum, lithium, magnesium, calcium alloys and halides thereof, etc. can be mentioned.

For the luminous material used in the application example, any organic EL material, for example, a metal complex such as a quinoline, a metal complex such as an azomethine, and conjugated monomers and conjugated polymers can be mentioned. Furthermore, the method is not limited to the deposition method, and coating of a solution produced upon dissolving in solvent can be used as well.

For the positive hole injection material, in addition to NPD, triphenylamine derivatives, polfine compounds, polyaniline and derivatives thereof, polythiophene and derivatives thereof, etc. can be used as the positive hole injection material in the application examples.

For the material used as the adhesive layer in the application examples, a resin that does not interfere with the positive hole injection and which is capable of melting under the heat generated by the laser beam and which has excellent adhesion with ITO and glass can be used.

For the sealer used in the application example, in addition to ultraviolet-curable resins, ultraviolet-setting resins can be used as well. In this case, it is not necessary for the protective substrate to be transparent.

Application Example 2

In this application example, an example of a manufacturing method wherein a light-heat conversion layer and a heat propagation layer are formed on the film, and, subsequently, a cathode layer is formed, then, an electric field emitting adhesive layer is laminated, and the above-mentioned multilayer film is applied to a substrate having an ITO with a striped pattern; then, a laser [beam] is applied from the backside of the film so as to form the cathodic shape and the above-mentioned multilayer is transferred to the substrate, the film is removed and the driving means is connected to the substrate transferred along with the above-mentioned multilayer, and finally, sealing is performed in the manufacture of a organic EL display device used for simple matrix drives, is described.

First, as in the case Application Example 1, a light-heat conversion layer and a heat propagation layer are formed on the film; then, as an electric field emitting adhesive layer, a coating of MEH-PPV

[Chemical formula 3]

//Chemical formula 3 here//

was applied in the form of a chloroform solution and drying was carried out to produce a film thickness of 70 nm. The film produced above was applied to a transparent glass substrate having an ITO as in the case of Application Example 1, the driver circuit was inserted and sealing was performed to produce an organic EL display device. When power and a signal were applied to the display device produced above, image display was possible.

Application Example 3

In this application example, an example is shown wherein an electron injection layer is placed between the cathode and the luminous layer in Application Example 1. A cross-section diagram of the organic EL display device of the application example is shown in Fig. 8. In Application Example 1, after formation of the cathode, deposition of Znq2

[Chemical formula 4]

//Chemical formula 4 here//

to form a thickness of 20 nm as electron injection layer 10 was carried out. And after formation of the luminous layer, production of an organic EL display device was carried out according to the procedure described in Application Example 1.

[p. 8]

In the organic EL display device of Application Example 1, the luminous efficiency was 2 lm/W, on the other hand, the luminous efficiency was 2.5 lm/W.

For the electron injection material used in the Application Example, in addition to oxadiazole derivatives, materials capable of producing electron

injection, such as polyphenylene vinylene derivatives and Alq3, can be used as well while taking the cathode and luminous emission layer into consideration. As for the film formation method, a method that does not cause damage to the cathode can be used.

The above-mentioned Application Example can be used for Application Example 2 as well.

Application Example 4

In this Application Example, an example is described wherein a light-heat conversion layer and a heat propagation layer are formed on the film, and, subsequently, an anode layer is formed, and a positive hole injection layer is formed; then, a luminous layer is applied, and an adhesive layer for positive hole injection is also applied, and the above-mentioned multilayer film is applied to a substrate having a cathode with a pattern, then, a laser [beam] is applied to the film from the backside of the film so as to form an anodic shape and the above-mentioned multilayer is transferred to the substrate, removal of the film is further performed and the driving means is connected to the substrate transferred with the above-mentioned multilayer, and finally, sealing is performed in the manufacture of an organic EL display device used for simple matrix drives. The cross-section diagram of the manufacturing method of the organic EL display device of the Application Example are shown in Fig. 9 through Fig. 14.

First, as a base film, a polycarbonate film with a thickness of 0.1 mm was used and the light-heat conversion layer and heat propagation layer shown in the above-mentioned Application Example 1 were formed on the above-mentioned film 1, and sputtering was further carried out with indium tin oxide to form anode layer 7 with a thickness of 200 nm (Fig. 9).

Then, deposition of MTDATA

[Chemical formula 5]

//Chemical formula 5 here//

was carried out to form a positive hole injection layer 17 with a thickness of 15 nm, and deposition of NPD also was carried out to form a thickness of 20 nm. Furthermore, for luminous layer 5, deposition of Alq3 to a thickness of 70 nm (Fig. 10) also was carried out.

Then, for adhesive layer 18 capable of achieving electron injection, [deposition] of a chloro-film solution of PPV to 60 nm (Fig. 11) was carried out.

The film produced above was applied to a transparent glass substrate having a cathode of aluminum and a lithium alloy onto which a pattern of 256 stripes was applied with a laser (Fig. 12).

[p. 9]

Subsequently, pattern formation of 64 stripes was carried out from the film side by a YAG laser 9 in direction perpendicular to that of the ITO stripe pattern (Fig. 13).

When the film was removed, an organic EL substrate having 256 x 64 picture elements having the structure shown in Fig. 14 was produced.

A controller and drivers were connected to the above-mentioned organic EL substrate as shown in Fig. 7, a transparent protective substrate was applied with an epoxy-type thermosetting sealer and sealing was done at ambient temperature. When power and a signal were input to the display device produced above, image display was possible. In this case, the luminous efficiency was 3 lm/W.

For the materials and method used in the above application example, those described in Application Example 1 above can be used as well.

Application Example 5

In this Application Example, an example is shown wherein a light-heat conversion layer and a heat propagation layer are formed on the film, and, subsequently, an anode layer is formed, and a positive hole injection layer is formed; then, the above-mentioned multilayer film is applied to a substrate having a cathode with a pattern; then, a laser [beam] is applied to the film from the backside of the film so as to form an anodic shape and the above-mentioned multilayer is transferred to the substrate, removal of the film is carried out and the driving means is connected to the substrate transferred with the above-mentioned multilayer, and finally, sealing is performed in a method of manufacturing an organic EL display device used for a simple matrix drive. Cross-section diagrams that show the manufacturing method of the organic EL display device of the Application Example are shown in Fig. 15 through Fig. 18.

The same procedure described in Application Example 3 were used up to the formation of the anode and positive hole injection layer.

Subsequently, coating of chloroform solution of PPV

[Chemical formula 6]

//Chemical formula 6 here//

was carried out for the electric field light-emitting layer 19 and dried [to form a thickness] of 60 nm (Fig. 15).

The film produced above was applied to a transparent glass substrate 8 having cathode 4 of an aluminum and lithium alloy onto which patterning of 256 stripes were carried out by a laser (Fig. 16).

[p. 10]

Subsequently, pattern formation of 64 stripes was performed from the film side with 13-W YAG laser 9 in a direction perpendicular to the stripe pattern of the ITO (Fig. 17).

When the film was removed, an organic EL substrate having 256 x 64 picture elements having the structure shown in Fig. 18 was produced.

A controller and drivers were connected to the above-mentioned organic EL substrate as shown in Fig. 7, a transparent protective substrate was applied with an epoxy-type thermosetting sealer and sealing was done at ambient temperature. When power and a signal were applied to the display device produced above, image display was possible. In this case, the luminous efficiency was 3.5 lm/W.

For materials and method used in the above-mentioned Application Example, those described in Application Example 1 above can be used as well.

Application Example 6

In this Application Example, an example wherein production of the above-mentioned luminous layer is carried out by coating, with an ink-jet head, luminous materials that had been dissolved in a solvent and which are capable of emitting red, green, and blue light to form the luminous layer in the above-mentioned Application Example 4. Cross-section diagrams of the manufacturing method of the organic EL display device of the Application Example are shown in Fig. 19 through Fig. 25.

The same procedures described in Application Example 4 were used up to the point of formation of the cathode on the film.

As shown in Fig. 19, a xylene solution of MEH-PPV was coated by ink-jet head 20 for the red-color emitting layer 21 to form a striped pattern and dried, and a xylene solution of PPV was coated next to the above-mentioned layer by an ink-jet head for the green-color emitting layer 22 to form a striped pattern and dried, then, a xylene solution of a fluorene compound
[Chemical formula 7]

//Chemical formula 7 here//

was coated between the above-mentioned MEH-PPV and PPV derivatives as a blue-color emitting layer 23 by an ink-jet head and dried as shown in Fig. 21 to produce a thickness of 60 nm (Fig. 22).

The film produced above was applied to transparent glass substrate 8 having cathode 4 made of an aluminum-lithium alloy having a 256 stripe pattern formed by a laser matching the direction of the stripes on the cathode (Fig. 23).

Subsequently, formation of a 64 stripe pattern was carried out from the film side with YAG laser 7 in the direction perpendicular to the stripe pattern of cathode 2 (Fig. 24).

[p. 11]

When the film was removed, an organic EL substrate having 256 x 64 picture elements with the structure shown in Fig. 25 was produced.

Drivers and a controller were connected to the above-mentioned organic EL substrate as shown in Fig. 7, a transparent protective substrate was applied with an epoxy-type thermosetting sealer and sealing was done at ambient

temperature. When power and a signal were applied to the display device produced above, image display was possible.

For materials and method used in the above-mentioned Application Example, those described in Application Example 4 above can be used as well.

The above-mentioned Application Example was based on the structure of Application Example 4, and the method can be applied to film formation of the luminous layer or electric field light emitting layer of the other Application Examples.

Application Example 7

In this Application Example, an example is shown wherein the partition walls are formed before formation of the cathode on the film. As shown in Fig. 26, printing was carried out for the film used in Application Example 5 with a thermosetting polyimide by screen printing method as shown in Fig. 26 so as to form partition walls 24 having a width equal to that of the space between the color emitting layers and heat curing was carried out. Subsequently, production of an organic EL display device was carried out according to the method described in Application Example 6.

When a color image was displayed using the display device produced above, a vivid color display without color overlapping was possible.

The material and the method used for the partition wall are not limited to the above-mentioned methods and materials as long as the structure shown in Fig. 26 can be produced.

In this case, as a means to isolate each color layer, a partition wall was used, but an ink repellent treatment can be imparted to the area between the picture elements after formation of the electrode as well.

[Effect of the invention]

In the past, pattern formation for the chemically unstable cathode has been made difficult, but according to the method of the present invention, cathode pattern formation can be easily achieved. Furthermore, the method can be applied to a structure in which the elements are reversed, and loss of light based on the light piping effect associated with light emitted through the glass substrate can be prevented. As a result, production of an organic EL display device having a high light emission effect using a simple method at a low cost is made possible.

[p. 12]

[Name of Document]

[Abstract] In production of an organic EL display device, patterning of the cathode and transferring of the luminescent layer are accomplished by means of a transfer method that utilizes a laser beam so as to simplify the process and to improve the display characteristics.

[Objective] In the past, pattern formation for the chemically unstable cathode has been difficult.

[Problem solving] In the method of the present invention, the transfer method is used and pattern formation of cathode 4 and formation of luminous layer 5 are performed by laser 9 at the same time.

[Name of Document] Fig. 5

[Brief description of figures]

[Fig. 1] A cross-section diagram that shows the production process of the organic EL display device of Application Example 1 of the present invention.

- [Fig. 2] A cross-section diagram that shows the production process of the organic EL display device of Application Example 1 of the present invention.
- [Fig. 3] A cross-section diagram that shows the production process of the organic EL display device of Application Example 1 of the present invention.
- [Fig. 4] A cross-section diagram that shows the production process of the organic EL display device of Application Example 1 of the present invention.
- [Fig. 5] A cross-section diagram that shows the production process of the organic EL display device of Application Example 1 of the present invention.
- [Fig. 6] A cross-section diagram that shows the production process of the organic EL display device of Application Example 1 of the present invention.
- [Fig. 7] A cross-section diagram that shows the production process of the organic EL display device of Application Example 1 of the present invention.
- [Fig. 8] A cross-section diagram that shows the organic EL display device of Application Example 3 of the present invention.
- [Fig. 9] A cross-section diagram that shows the production process of the organic EL display device of Application Example 4 of the present invention.
- [Fig. 10] A cross-section diagram that shows the production process of the organic EL display device of Application Example 4 of the present invention.
- [Fig. 11] A cross-section diagram that shows the production process of the organic EL display device of Application Example 4 of the present invention.
- [Fig. 12] A cross-section diagram that shows the production process of the organic EL display device of Application Example 4 of the present invention.
- [Fig. 13] A cross-section diagram that shows the production process of the organic EL display device of Application Example 4 of the present invention.
- [Fig. 14] A cross-section diagram that shows the production process of the organic EL display device of Application Example 4 of the present invention.

[Fig. 15] A cross-section diagram that shows the production process of the organic EL display device of Application Example 4 of the present invention.

[Fig. 16] A cross-section diagram that shows the production process of the organic EL display device of Application Example 4 of the present invention.

[Fig. 17] A cross-section diagram that shows the production process of the organic EL display device of Application Example 4 of the present invention.

[Fig. 18] A cross-section diagram that shows the production process of the organic EL display device of Application Example 4 of the present invention.

[Fig. 19] A cross-section diagram that shows the production process of the organic EL display device of Application Example 5 of the present invention.

[Fig. 20] A cross-section diagram that shows the production process of the organic EL display device of Application Example 5 of the present invention.

[Fig. 21] A cross-section diagram that shows the production process of the organic EL display device of Application Example 5 of the present invention.

[Fig. 22] A cross-section diagram that shows the production process of the organic EL display device of Application Example 5 of the present invention.

[Fig. 23] A cross-section diagram that shows the production process of the organic EL display device of Application Example 5 of the present invention.

[Fig. 24] A cross-section diagram that shows the production process of the organic EL display device of Application Example 5 of the present invention.

[Fig. 25] A cross-section diagram that shows the production process of the organic EL display device of Application Example 5 of the present invention.

[Fig. 26] A cross-section diagram that shows the production process of the organic EL display device of Application Example 6 of the present invention.

[Explanation of codes]

1: Film

2: Light-heat conversion layer

- 3: Heat propagation layer
- 4: Cathode
- 5: Luminous layer
- 6: Positive hole injection adhesive layer
- 7: Anode
- 8: Transparent substrate
- 9: Laser
- 10: Electron injection layer
- 11: Organic EL substrate
- 12: Protective substrate
- 13: Sealer
- 14: Scanning electrode driver
- 15: Signal electrode driver
- 16: Controller
- 17: Positive hole injection layer
- 18: Electron injection adhesive layer
- 19: Electric field light emitting layer
- 20: Ink-jet head
- 21: Red-colored light emitting layer
- 22: Green-colored light emitting layer
- 23: Blue-colored light emitting layer
- 24: Partition wall

[Translator's note: please see source document for figures and chemical structures.]